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NOTES ON THE BIOLOGIES OF MEGACHILE FRIGIDA SMITH AND M. INERMIS PROVANCHER

(Hymenoptera: Megachilidae)[1]

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During alfalfa insect investigations in the Sprague area of southeastern Manitoba in 1948 and 1951, preliminary studies were made of the nesting habits of two leaf-cutter bees, *Megachile (Delomegachile) frigida* Smith and *M. (M.) inermis* Provancher. In 1952 these two species were studied more intensively in the Ravendale district of northern Saskatchewan.

The features of the areas harboring species of *Megachile* were discussed by Stephen (1955:543–584) and it was suggested that a sequence involving decaying and decayed timber is essential to the propagation of certain species; the possibility of the occupation of vacant wood-borer holes by *Megachile* spp. was discounted and some contribution was made to a study of the environmental effect on bee populations.

Megachile frigida Smith

This species is the most common megachilid found on alfalfa in the two areas and is most abundant in the sandy, wooded, western edge of the Laurentian shield. All of the notes were made on specimens nesting in decaying poplar. A total of 48 nests of this species were observed at various stages of construction in the years 1948, 1951, and 1952.

The most nearly complete account of nesting habits of the larvae was obtained from an individual nesting in a small poplar log lying in the midst of a 19-year-old burn.

At 2:35 p.m. on July 7, 1952, a female was observed to begin excavation of a tunnel on the upper southern face of a log. She excavated continually except for short flights requiring not over 10 minutes until 6:15 that evening. By that time the tunnel was slightly over four inches long and a pile of sawdust had accumulated beneath the entrance. Because of inclement weather, observa-

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tions were not resumed until July 9, at which time rain and wind had all but disposed of the sawdust, and the bee was in the process of cell construction. At 11:13 she left the nest, returning with a load of pollen at 11:38. She remained in the nest for 4½ minutes and then left again, returning with another pollen load at 11:58. This time she remained inside the nest for three minutes before leaving. At 12:37 she returned with the last pollen load for the cell. After 11 minutes in the nest she emerged and flew to a *Ribes* shrub about 25 feet from the nest. The first leaf-cutting was obtained in 11 seconds, followed by four more trips of 9, 16, 14, and 14 seconds respectively. All of these leaf-cuttings were round and small and were presumed to serve as cappings for the cell. On her return with the last capping, she remained in the nest for 6½ minutes.

Upon emerging she alighted on a log near the nest entrance and rested, expanding and contracting her abdomen. Then she re-entered the nest, emerged soon, and returned to the *Ribes* shrub, where she secured an oval piece of leaf slightly longer than her body. She obtained three more cuttings similar in size to the first in rapid succession and then remained in the nest for 37 minutes. During this period she would emerge from the nest at regular intervals and rest on a nearby log, where she would manipulate her abdomen. This abdominal manipulation continued for 1½ to 4 minutes and was followed by an immediate return to the nesting tube. Four more leaves were cut and transported to the nest before pollen and nectar gathering was begun. Two of the four pieces were cut from nearby *Ribes* shrubs and on both of these trips the female returned within 20 seconds. However, the third trip required 1 minute and 35 seconds and the fourth 48 seconds to complete. On the latter two trips the leaf cuttings had a much deeper green color and were much more glossy, and the source of the cuttings is not known.

At 4:44 she brought in the first load of pollen, unloaded, and was in flight 3½ minutes later. The second load of pollen was collected in 31 minutes, but during the 10 minutes before the return of the bee a light rain began falling. The rain increased in intensity and did not abate until 6:25. For the period of heavy rain the bee remained near the entrance of the burrow but took to flight as soon as the intensity of rain decreased. She returned at 6:40.

Observations were continued at the same nest at intervals throughout July and early August but because of the extremely wet weather it was impossible to make observations on successive days. However, there was considerable variation in all of the routine associated with cell construction. The time required to secure leaf cuttings varied from 9 to 13 seconds per cell; pollen loading required 11 to 65½ minutes; and probably a cell was formed under optimum flying conditions.

On July 28 the nest started on July 7 was exposed. There were nine completed cells and a lethargic female in the tunnel at the time. The cells were transferred to a ¼-inch glass tube for further observation. Three other small logs containing nests of *frigida* were removed to the laboratory in the hope of obtaining information on emergence dates.

The last-formed cell of the transferred nest was opened carefully on July 28 and placed in a small piece of ¼-inch tubing. The base of the tube was sealed with sealing wax and the apex plugged with cellulose cotton. The cotton plug was moistened daily to provide a suitable humidity for development. The food in the cell was entirely eaten by August 23 and the larva began to pupate on August 28. The cell was again examined on August 30, at which time the larva was dead, probably as a result of a fungus infection.

Six specimens of *frigida* were caught in the southeast part of Manitoba and the pollen was compared with samples obtained from the more common plants of the area. Three of the specimens had collected alfalfa pollen exclusively. The other three carried alfalfa pollen predominantly but had lesser amounts of fireweed and two unknown plant species.

One baffling situation that has arisen concerning *frigida* is the mortality of larvae in the nests brought into the laboratory. Six logs containing nests of this species were taken to the laboratory in 1947, four in 1948, and eight in 1951, but from these not a single adult specimen emerged. Upon examination, the cells contained dried remnants of the bees in a late pupal stage. None of the cells examined contained adults. From this it might be construed that this species nests under other, more favorable conditions and that poplar logs may be a limiting factor in its abundance. That the species nests in spruce has been substantiated, but year after year it is the most abundant species of *Megachile* in Manitoba and is most readily found in decaying poplar logs.

MEGACHILE INERMIS Provancher

Observations on the nesting habits of *inermis* had been recorded for three summers in the Sprague area of Manitoba, but it was not until the summer of 1952, near Ravendale, Saskatchewan, that I was able to follow a single female through the completion of its nest. The nest was found on July 4 at 2:30 p.m. in a habitat of decaying poplar similar to that described above. The bee was sighted while in the process of tunnelling in a charred poplar log, 16 inches in diameter, the entrance being in a crevice on the east side. This nest was marked and a search for other nests begun. At 5:30 I returned to the first site and was surprised to note that the bee had bored two holes, one being used as an entrance and the other as an exit. The holes were about 1½ inches apart, with one lower than the other. She was in the process of removing sawdust from the lower hole in the following manner. The wood was pushed to the entrance until the hole was plugged. She then backed through the accumulation and scattered it by flailing at it with her hind and mid legs. She continued to back away from the entrance hole and cleared the immediate vicinity of the burrow before re-entering. After leaving the hole the bee entered via the upper. The excavation continued until dark.

On July 20 I was able to re-observe the nest, and noted that the female was in the process of ejecting volumes of sawdust. I cannot be certain that the female was the same one that I noted on July 4, but she was well frayed and examinations showed that the mandibles were well worn. To permit closer examination, the portion of the log covering the nesting tunnel was carefully whittled away and seven cells were exposed. Immediately above the last-formed cell was a side tunnel. This was carefully exposed along its entire length so as to barely expose the side tunnel. The portion of wood was immediately replaced with a piece of glass tubing cut longitudinally. The wood-glass interfaces were sealed with putty and liquid glue. The bee had been in the tunnel at the time of exposure and became somewhat excited at the sudden entrance of sunlight. She left via the entrance hole and flew about the nest for several minutes before re-entering. By the time she returned, the glass had been put in place and the tunnel was once again weather-tight. She inspected the tunnel and removed all of the foreign matter that had fallen in. The larger pieces, which were unwieldly, were chewed into several smaller fragments before being ejected. She continued tunnelling to a point beyond the end of the first-formed branch. At the end of the tunnel she gathered some of the sawdust chips and tapped them with her legs and head as if forming a footing for the cell to be constructed.

In spite of rain and heavy clouds, she then took numerous short flight about the nest, repeatedly entering and leaving the nest. After about 20 minutes of this she left the locale and returned 24 seconds later with a piece of leaf. This was pulled into the nest and placed about the base and the lower surface of the tunnel. A second piece of leaf, secured from *Ribes* sp., was cut in five seconds and placed in such a position as to cover some of the base and lower lateral portions of the tunnel. The second leaf overlapped the first considerably. A third leaf required 22 seconds to obtain and was much larger than either of the first two cut. This was placed in the latero-basal part of the cell, completing the bottom half of the cell. She then secured six more leaves in 20, 38, 31, 16, 25, and 86 seconds in succession. These were placed about the sides and bottom of the cell with great care and several rearrangements.

At this stage the bee began working diligently about the inner surface of the cell, secreting orally a substance that appeared to be weblike in form. After this weblike base had been deposited over a small area, she laid down a blackish oral secretion that hardened very rapidly. During the process of lining or "insulation," she would emerge periodically and sit on a nearby log. At these times she would manipulate her abdomen in great haste, expanding, contracting, raising, and lowering it for 2 to 4 minutes. After each spell of abdominal manipulation she would enter the burrow and cover some of the inner surface with the dark substance, spending 8 to 21 minutes on the latter act. This sequence of insulating and abdominal manipulating continued for 2 hours and 15 minutes before two more leaves were cut and placed. These, too, were insulated before pollen-collecting commenced.

Seven loads of pollen, mixed with nectar, were deposited in the cell and the egg was laid on the mass. The time required to collect each load was 17 to 38 minutes, 6 of the 7 taking over 25 minutes. Three circular leaf cappings were placed on the cell.

Because of wet weather the nest was not examined again until August 5. Five cells had been formed under the glass, cotton, and cardboard cover, and the bee was engaged in the construction of the sixth. At this time the glass cover was removed and the four leaf cuttings in place for the sixth cell were disturbed with the point of a pencil. The bee, entering with her fifth leaf, found her work tampered with and began to remove from the tunnel all of the leaves that were out of place. Three were deposited outside the entrance and the fourth was cut up and placed on the top of the last-formed cell of the first tunnel. She began accumulating several new cuttings and the bee was then caught and killed.

The cells were all transferred to a ¼-inch glass tubing in the sequence in which they had been constructed. All of the cells in the main tunnel were placed below the five from the side tunnel. The base of the tube was sealed with paraffin and the apex plugged with cotton batting. It was expected that the last-formed cell would yield the first adult but such was not the case. The tube was kept in the laboratory for the winter, and on April 17 the first male emerged from the last-formed cell of the first-constructed tunnel. In doing so it chewed its way through the five cells above it, damaging, exposing, or destroying all of the pupae above it. On April 18 another male emerged from the cell below that occupied by the first-emerged male, and crawled to the cotton batting plug.The second male destroyed all of the pupae that were still alive. The third male emerged on May 4. Up to the beginning of June none of the four cells below those yielding males had shown signs of viable contents.

In a nest of *inermis* found in a well-decayed poplar log on July 20, two females were working the same hole. One appeared to do nothing except dig and remove sawdust, while the other made frequent collecting trips. The nest was then marked and examined on August to determine whether a bifurcate tunnel was being formed. The tunnel consisted of a short tube no more than four inches long with no secondary branches. In the tunnel there were three cells that had been soaked by rain seeping through the overdecayed log. The nest had probably been vacated after the first rain, for there were several leaf cuttings above the three cells. The cells were opened and three viable larvae in various stages of development were noted. An attempt was made to rear the larvae through to adults by placing each cell in a short piece of glass tube. Two young larvae desiccated on August 16 and a third died on August 20, possibly because of the lack of moisture. None reached the pupal stage. A similar situation was observed with *frigida,* two females appearing to have a common nesting tube.

Reference

STEPHEN, W. P.
1955. Alfalfa pollination in Manitoba. Jour. Econ. Ent., 48(5):543-548.

ZOOLOGICAL NOMENCLATURE: Notice of proposed use of the Plenary Powers in certain cases for the avoidance of confusion and the validation of current nomenclatorial practice (A.(n.s.)25)

Notice is hereby given that the possible use by the International Commission on Zoological Nomenclature of its Plenary Powers is involved in applications relating to the under-mentioned names included in Parts 9 and 10 of Volume 11 of the *Bulletin of Zoological Nomenclature,* both of which Parts will be published on 30th December, 1955. Notice is also given that the possible use of those Powers is involved in one application included in Part 12 (the final Part) of Volume 9 of the same publication, which will be issued in January 1956.

(1) Applications in Part 9 of Volume 11

(1) *Lepisma* Linnaeus, 1758 (Class Insecta, Order Thysanura), attribution of a gender for, in harmony with accustomed usage (Z.N.(S.)988)

(2) Application in Part 12 of Volume 9

(2) Curtis (J.), 1837, *A Guide to an Arrangement of British Insects* (Ed. 2), suppression of, for purposes of selections of type species of genera (Z.N.(S.)298)

Any specialist who may desire to comment on any of the foregoing applications is invited to do so in writing to the Secretary to the International Commission (Address: 28 Park Village East, Regent's Park, London, N.W. 1, England) as soon as possible. Every such comment should be clearly marked with the Commission's File Number as given in the present Notice.—FRANCIS HEMMING, *Secretary to the International Commission on Zoological Nomenclature.*

ERRATUM

In the April issue of the Pan-Pacific Entomologist (Vol. 32), pages 63 and 65 of the Gilbert "Raymondionymine weevils" were inadvertently transposed.